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Frederick T. Rall

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Frederick T. Rall, Jr.

Interview 1

Cold War Aerospace Technology History Project



Interview Conducted and Edited by Gino Pasi
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Interviewee: Frederick T. Rall, Jr.
Interviewer: Gino J. Pasi
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Interview One (False Start)
Video Tape One

00:00:00 Gino J. Pasi: Today is Friday, August 31, 2007. We are talking this morning to Mr. Frederick Rall who, when he retired from the civilian workforce at Wright-Patterson Air Force Base in 1989, was the Technical Director, Deputy for Engineering over the Aeronautical Systems Division. This interview is being conducted in the studios of the Center for Teaching and Learning at Wright State University as part of the Cold War Aerospace Technology History Project. The interviewer is Gino Pasi and as I said our interviewee today is Mr. Frederick Rall. Mr. Rall, thank you so much for taking some time to be with us this morning.

00:00:54 Frederick T. Rall, Jr: Glad to be here.

00:00:55 Pasi: That's good. Why don't we start, if you would, maybe you could just give us a brief synopsis of your childhood and maybe transition into your education, and what if any, were some early indicators of the future career path that you ended up choosing.

00:01:18 Rall: Well let's see. I was born in Oak Park, Illinois, on the 16th of September, 1928. That's where the hospital West Suburban was, but I lived and was raised in a suburb called Forest Park, which is about 10 miles due west of Chicago; went to parochial school. [I] had a pretty good education from that school, Saint John's Evangelical Lutheran. [I] went to a public high school, which had a high, good—very good reputation, good math department, good science department, and I found myself interested in physics and mathematics. And in my senior year a math teacher, Martha Hildebrandt—great teacher—what would be called an “old maid” in her time, who just loved to teach, took me underneath her wing and sort of taught me about colleges. Because even though I was taking the college preparatory course in high school, I really hadn't really given any thought as to where I wanted to go when I finally graduated. She had a nephew who had gone to M.I.T. and she really touted that school to me and she finally talked me into applying for that school. That's the only school I applied to. That was in 1946 which was right after the end of World War II and there were a lot of returning

servicemen, so the place was really crowded back then. But I managed to get a scholarship for half the tuition. In 1946 the tuition for a year at M.I.T. was six hundred dollars and I [laughs] got a scholarship for three hundred dollars. My interest in aeronautics began when I was a boy in building model airplanes. I'd [loud noise in studio] I would get regular model kits made out of—cut out of—balsa woods [more studio noise] and covered with paper, silk paper, and fly them. I found out that flying was more difficult than the building was because I didn't understand the balance and where the center of gravity was, and things, and so I started looking into learning things. During World War II of course [more studio noise] there was a lot of glamour associated with being a pilot and my eyes weren't good enough for me to become a pilot so, since I was interested in math and logic anyhow, I thought that being an—engineering—aeronautical engineer would be good. So when I signed up for college that's what I signed up for. I had also between my senior and junior year of high school worked at a Douglas aircraft plant which had been built by Douglas in what is now O'Hare airport. That's how O'Hare airport got started. I worked—they built a C-54 a day [laughs] during the war and I—

00:04:59 Video Technician: Excuse me, can I, I'm sorry. We need to cut, I apologize.

00:05:02 Pasi: Oh that's alright.

00:05:03 Video Technician: We just—I forgot to tell everybody to turn their cell phones off; and I went to turn my cell phone off— [Recording ends].

Interview One (Second Start)

Video Tape One

00:00:00 Gino J. Pasi: Today is Friday, August 31, 2007. We are talking this morning to Mr. Frederick Rall who, when he retired from the civilian workforce at Wright-Patterson Air Force Base in 1989, retired as the Technical Director, Deputy for Engineering over the Aeronautical Systems Division. This interview is being conducted in the studios of the Center for Teaching and Learning at Wright State University as part of the Cold War Aerospace Technology History Project. The interviewer is Gino Pasi and as I said our interview[ee] today is Mr. Frederick Rall. Mr. Rall, thanks so much for being here with us this morning.

00:00:45 Frederick T. Rall, Jr: Happy to be here Gino.

00:00:46 Pasi: Thank you. I guess to start, could you please provide us maybe with a brief synopsis of your childhood, or maybe your education, and what prompted you to study what you ended up studying in college.

00:01:03 Rall: Well let's see. I was born on 16th of September in 1928 in a suburb of Chicago called Oak Park, Illinois, but I was raised in a suburb called Forest Park. The school that I went to—grammar school—was a parochial school which was only a half a block away from where I lived. So we had a lot of [play] times; contrary to the current thing I heard on the radio today about not allowing “tag,” we had a lot of heavy [laughs] games we played during grammar school. [I] went to a public high school, Proviso Township High School—good academic school. [I] was taken underneath [the] wing [of] a couple of teachers. One was a public speaking teacher who taught me a lot of the good things about public speaking, which turned out to be very important in later life—being able to communicate with your peers and with your superiors. Also she got me to act in the junior play and eventually I became the president of the Proviso Players [laughs] which—acting is also a good thing to have in future life [laughs]. But the most important one was Martha Hildebrandt, who was an “old maid” school teacher who just loved teaching, and loved kids, and she took me underneath her wing and told me about her nephew who had gone to M.I.T. And she touted that school and she was the one who said that's where I ought to apply. And so I did and eventually got a scholarship for half the tuition. Tuition for a full year was six hundred dollars at that time and my scholarship was three hundred dollars, and so I was happy when I finally got accepted. If I hadn't been accepted I would have been [laughs] out of luck. I don't know what I would've done. The school was crowded because it was 1946 when I started and all of the veterans were coming back and the school was really crowded.

But my interest in aviation began when I started building model airplanes during grammar school, and built them out of balsa and covered them with paper silk and got them to fly. And flying was harder than building them because I didn't understand where the center of gravity was relative to the center of pressure and [flight] control characteristics, and so I got interested in learning all about that so I could fly those model airplanes. My models were powered by rubber bands; [laughs] not motors. I couldn't afford motors.

00:03:49: Pasi: The old kind you would just sort of wind up and throw.

00:03:51: Rall: And throw, that's right. And I did have a couple of gliders but—and one of my sister's boyfriends was flying gasoline powered model airplanes and that also intrigued me. But I couldn't afford to buy the motored or try that out.

And then of course during World War II being a pilot was a very glamorous thing, and I would have like to have been a pilot, but my eyes were never that good. So I never gave that a really serious thought, but I thought engineering would be good.

I also between my junior and senior year in high school worked at a Douglas aircraft plant near Chicago. They had built the airport, what is now O'Hare Airport, during the war and produced one C-54 a day. I worked as an installer in

the upper fuselage putting “sky felt,” and rivet plates, and fiberglass installation in the upper fuselage. When I started it was supposed to be an eight hour-a-day job that they had laid out for me. And it was sort of interesting as I progressed after a few weeks I could do the job in five hours and my bosses told me “not to worry about that; just go find someplace in a hole down in the bottom of the fuselage and go to sleep [laughs].” Of course I didn’t do that; I just kept learning what the other people were doing. They would disappear for a time, but I was more interested in learning other jobs. I also learned what real life in building aircraft is. One day I stepped on a drill and the drill bit went into the floor of the aircraft. So I asked now what do I do, as far as damage? He said “well you take this green gunk and you cover it up, and that’s the same color as the Alclad covering over the aluminum and you hope the inspectors don’t find it.” [Laughs] I learned that there’s a fundamental contest between the inspection people and the people who are actually constructing the aircraft. And [laughs] that was a real education.

00:06:08: Pasi: I’m sure. Now—was that a job that—you got that job when you were in high school; is that correct?

00:06:14 Rall: In the high school between my junior and senior years.

00:06:15 Pasi: Was that a job someone easily came by at that point?

00:06:19 Rall: Oh yeah. They were looking for people during that time because there was a labor shortage because of everybody being drafted to go to the war, so it was easy to get that kind of a job; it wasn’t hard at all.

So then when I went to M.I.T. I took a course in aeronautical engineering. Of course the first year was all sort of standard practice [laughs] and it was harder than hell. High school had been easy, relatively easy. But I remember one Saturday morning when I was studying and I said to myself “Fred, don’t ever forget how hard this is because [laughs] later on you’re going to forget it, but don’t forget it.” It was really hard. I had gone out for crew in my freshman year—beginning there—and I would go after work, I mean after school, and practice on the crew. And the first test I took was a chemistry test; I never did like chemistry. And I failed the chemistry test, so I dropped crew [laughs] and went back to doing [nothing] except studying.

00:07:34 Pasi: Time to refocus.

00:07:35 Rall: That’s right.

00:07:36 Pasi: Yeah. Another lesson learned.

00:07:37 Rall: Right. And my sophomore year I started taking really aeronautical courses. And I had a professor; it’s funny how you remember particular people by—his name was Shatswell Ober. What a name. One of the greatest, nicest guys you

ever wanted to meet and he was teaching a design course. And he gave a quiz and the quiz lasted a whole hour. And of course back then we were doing calculations with slide rules. There were no such things as hand-held computers or anything like that, so when I got done with the program—with the test—I handed in the paper. And the next day I got it back and I got a zero. And here I thought I had absolutely clobbered the thing; I thought I had it done exactly right. Turned out I had misplaced the decimal point in the final answer. And Shatswell wrote a note on the paper that said “if you can’t tell the difference between a thirty thousand pound airplane and a three thousand pound airplane, you deserve a zero. So that’s what I got. I mean that taught me something very seriously about how important understanding what the numbers said was.

00:08:51 Pasi: Yeah

00:08:51 Rall: And that was good. Eventually I was invited to join an honors course in aeronautical engineering. It was headed up by Dr. Draper who is now in the aviation hall of fame. It was a course in which he took a few people underneath his wing and had them once a month out at various places, even his home, out to Hanscom Air Force Base, looking at some of the classified work that they were doing in the way of celestial navigation back at that time. And the program was designed so you would get a bachelor’s degree and a master’s degree at the same time. Of course you’d go five years, but it was well worthwhile doing, and I appreciated the kind of learning experience that that gave me.

One day in my senior year I was walking by a bulletin board and I noticed there was an ad there to apply for a fellowship at Caltech. And I had been interested in Caltech because they probably had the second best aeronautical engineering course in the country. And so here was a chance to apply for a scholarship to go out there. And I had always been interested in California because that was the center of aircraft business anyhow back in those days. So I applied. And I didn’t win, but I did get offered a sort of co-op job where I could go to work at the co-operative wind tunnel that they had during the summer time preceding the school year, and work there during the school year while I attended classes. So I decided I’d graduate from M.I.T. after the end of four years, and just got my bachelor’s degree. And then went out to California and lived in Pasadena for a year working at that wind tunnel, which got me interested in aerodynamics. Met a lot of people there, a lot of contractor people, and a lot of good people from school, and learned a lot. [I] had an interesting comparison when I [was] going to Caltech versus M.I.T. At M.I.T. everything was completely practical. You solved problems that had direct application to the business. I mean you came out with numbers as answers. Whether the airplane weighed three thousand pounds or thirty thousand pounds, that’s what you did. At Caltech I never solved a problem during the whole year. The only thing I did was derive equations. It was really interesting.

00:12:03 Pasi: So you’re still doing numbers work.

- 00:12:05 Rall: I'm—[laughs]—but I'm deriving equations; I'm not feeding numbers into the equations, I'm just [doing] basic derivations.
- 00:12:13: Pasi: Ok.
- 00:12:16: Rall: [I] had a math class being taught by a graduate student who was the first—had just solved for the very first time the pressure wave from a nuclear explosion. [Laughs] Nobody else in the world had done it. He gave us a test that day in which I ended up getting a seventeen out of a hundred. And I was the high grade in the class. Can you imagine that? I mean—[laughs]—I learned absolutely nothing from him. But on the other hand I had Hans Liepmann who taught essentially aerodynamics—really a great professor and a great teacher—and I just got more and more interested in aerodynamics.

So finally when I graduated from Caltech, I had options of where I wanted to go to work. And it boiled down between two places. One was down at Tullahoma, Tennessee, where they were building a propulsion wind tunnel, which was the big wind tunnel brought over by—from the Germans. Germans had built it, but hadn't assembled it. And it had a sixteen foot test section and could run jet engines in it. And I was interested in it because of my background in working in the co-op wind tunnel. The other option was to go to work for Douglas in El Segundo which was a Navy operation. I finally chose them and went to work there and became an aerodynamicist working for them.

I spent my first six months with a degree from M.I.T. and a degree from Caltech doing nothing but pushing a Friden calculating machine for six months. All I did was add, subtract, multiply, and divide numbers on this Friden calculating machine—big machine, mechanical, lots of dials and things going—and probably one of the best experiences I ever had, although I didn't think so at the time, because I could spot if I had made a calculation [error] by looking at the numbers almost automatically. I mean I could ninety-nine point nine percent of the time I could see whether I pushed the wrong key and got the wrong answer just by looking at the number.

Eventually [laughs] they let me do some work—in the way—in the engineering field directly. And I was fortunate in that the first job I got I provided an answer to the problem that had plagued the company for several months. Douglas was building an airplane called the F3D-2. It was a night-fighter aircraft, Navy, straight wing, which was .015 Mach numbers slow. That doesn't sound like much these days, .015 Mach number, but back then that was a big thing to the Navy. And I was given the task of looking at what there possibly could be in the way of installation of the engines that could account for that. And I happened to be working on the exhaust nozzle and found out that the way that Douglas had supplied the exhaust nozzle—because it was side fuselage installation—that was accounting for too large an exit area on the exhaust nozzle when they got up to altitude. And so the engine wasn't producing the thrust that it was supposed to.

And so we—I—designed a new set of nozzles to put on and I got to test those out at Edwards Air Force Base, which is my first trip out to Edwards.

00:16:25 Pasi: Now at this time Mr. Rall were you transitioning into internal aerodynamics?

00:16:28 Rall: Yes this was definitely internal aerodynamics rather than the external aerodynamics in which I was working on. The next job after the F3D problem was the inlet ducts. I designed the inlet for the A3D which was a Navy version of the B-66. And worked on the supersonic inlet for the Navy airplane called the F5D which never really got very far. But continued to do that kind of work for a time.

During that time period the Korean War was going on and my draft board back at home was classifying me 1-A. The California appeal board would give me an occupational deferment.

00:17:26 Pasi: And that's what 1-A means?

00:17:29 Rall: No, the 1-A meant that I was ready to go.

00:17:32 Pasi: You were ready to go, ok.

00:17:33 Rall: I was ready to go. I forget the exact number for the occupational deferment; it was something like 4-D or something like that. And that went on for several cycles. And finally after another cycle when I thought it had been completed, my draft board back at Forest Park had a lot of pressure put on them by the local people because they accused the draft board officials of being prejudiced because my mother had worked for the draft board during World War II, and they thought I was getting special treatment and therefore they said "this isn't fair." So in order to do away with that kind of criticism the local draft board appealed the California Appeal Board decision to the Presidential Appeal Board. And the Presidential Appeal Board said "this guy looks like he's been dodging the draft; let's classify him 1-A." So I got a notice in the mail that said "please report down to the Los Angeles Draft Board for your physical and mental exam. So when that date—

00:18:52 Pasi: We don't care what you're working on.

00:18:53 Rall: That's right. And I had just voted for General Eisenhower in my first presidential election. [Laughs] But he did it. I went down and took my physical, and they give you some kind of mental test, not very complicated. And when I got done, I was sitting around with everybody else waiting to see what was happening. My name was called and I was told to report to—room—up on the second floor some place. And so I did and there was the number two guy in the local draft board who asked me whether I had some way to not get drafted

because he had looked at my test results, and he didn't think I'd be happy being a private in the army. I told him I could identify with that. And I told him that I had taken ROTC at M.I.T. and had a commission as a Lieutenant in the Air Force Reserve. I had taken ROTC the first two years because M.I.T. was a land grant college and it was mandatory for every student to take the R.O.T.C. I took the last two years ROTC not because I was interested in the service, but because they were paying money, and I forget what the amount was, seventy-five dollars a week or something, not very large in these day's dollars, but it was big to me then. And so I took that and got the commission as a Second Lieutenant in the Air Force Reserve. I was inactive all that time. Never did anything after I graduated from M.I.T. But the draft board individual, when he heard that I was in the reserve, called up a friend of his, a major up in Hamilton Air Force Base outside of San Francisco; told him he was going to send me up there the next day and see if he could get me into the Air Force. So I hopped on an airplane the next day, flew up there, raised my hand, and said "I do," and was sworn in as a Second Lieutenant on active duty. I still had to report back to Wright Field, which is where they eventually sent me, before my draft date otherwise the draft would have got me first. It's nice to have two organizations out for your body [laughs]. So I hopped in my little Jaguar that I was driving at the time and drove back to Wright Field and arrived without any idea of what a military man was supposed to do. [laughs] It's sort of interesting. When I reported to Wright Field, I reported to the same office which I occupied at the end of my career [laughs].

00:21:56 Pasi: My goodness.

00:22:00 Rall: They sent me up to the Aircraft Laboratory at that time after I told them what my experience at Douglas was, and so I went to work up there in the aerodynamics branch in the Aircraft Laboratory doing whatever I was asked to do. The first job they asked me to do was to calculate the takeoff distance of the KC-135 on a max-weight takeoff. Back then again we didn't have any calculators; everything was done by hand, slide rule calculations. So I sat down; got the drag figures, the thrust figures, and did the calculations on the acceleration and the airplane could never reach takeoff speed because it just didn't go fast enough; drag was too high. And so I had to go back and you made great simplifications back in those days because you didn't have the computational power that you have today. So I had to go back and calculate the amount of fuel used in small increments of time in order to lessen the weight of the aircraft. As I did that, I finally got it off the ground, but it was just barely. It got off the ground only because I had reduced the weight of the airplane.

Later on, years, years, later, there was a around-the-world flight; I remembered it was around-the-world flights going out of—three KC-135s out of a air base in western Massachusetts. They were all loaded down heavy with fuel, max takeoff gross weight, and one of them didn't make it and crashed at the end of the runway. And I mean it was marginal for sure. But I also learned a little bit about external aerodynamics at that time; we would do drag calculations from a three-

view drawing. I was given a three-view drawing and a planimeter. A planimeter—

00:24:18 Pasi: In layman's terms is a—

00:24:19 Rall: —is something that measures area, enclosed areas. And you would go through and calculate what the area—exposed area—skin area of an aircraft was. And you would then be able to calculate what the skin-friction drag was for that particular aircraft design.

00:24:47 Pasi: If I can interrupt?

00:24:48 Rall: Sure

00:24:51 Pasi: How did your work at Wright-Patterson, now that you were a Second Lieutenant in the Air Force, differ from say your work at Douglas. And you've mentioned that a little bit.

00:25:00 Rall: Well, I got to broaden in Wright Field. I was fairly confined in Douglas. When I, for instance, did the work on the F3D, I was not allowed to participate in the meeting with the Navy folks who came in to review the results of my work. My boss would go and his boss would go, but I was not allowed because I wasn't senior enough to attend.

00:25:34 Pasi: On a problem that you had solved, essentially

00:25:36 Rall: That I had solved right. And so I mean it was sort of interesting. Along that same venue, when I was working at Douglas in the upper fuselage back during my high school days, I [laughs] noticed that periodically men in suits and ties would come by and they'd stand around, and they'd look at something. And I always said "boy I'd like to be one of those guys instead of [laughs] one of the workers here who's sweating and getting fiberglass in their pores. And so I had that ambition to eventually become that kind of individual. And the more I worked at Wright Field, the closer I could see that I could actually achieve that kind of a status of working with other people.

I [laughs] established early on in my career at Wright Field that I was somewhat of a—of a radical. I was called upon to go down to the headquarters and meet with the commander, and review a problem on the F-101 aircraft on engine stall. Present there were the two-star general, head of the Propulsion Laboratory, and "hanger-oners," high rank civilians, and other high-rank military people. Turns out that the F-101 aircraft had a problem with engine stalls and they were trying to find out what the matter was.

00:27:20 Pasi: Now could you explain engine stall briefly

00:27:22 Rall: Engine stall—[laughs] an engine stall—is when the engine no longer produces thrust.

00:27:27 Pasi: Ok

00:27:28 Rall: It just—the motor is turning over. The turbine and the compressors are turning over. But it's like an aircraft wing stalling, when there's not lift on the compressor blades and the air stops going through the engine instantaneously. And you lose thrust. And so I mean it was a serious problem; it's not anything you want to have happen.

The head of the propulsion laboratory, Colonel—I think his name was Colonel—Appold was standing up and telling this two-star general that it was all because the inlet on the F-101 was no good; that they had lots of tests on the engine and it showed conclusively running behind the bell-mouth that the engine was beautiful and since—they had—they were responsible for the development of it, how could it possibly be wrong.

So as a Second Lieutenant I stood up, said “the Colonel didn't know what he was talking about” to this—in front of—this two-star general and went on to explain that the real world was that the engine's going to half to operate behind an inlet; that the inlet is not going to provide the nice smooth air that a bell-mouth does and they've got to start doing tests on the engine during the development process which recognized that the air is going to be distorted coming in, in order to—and design the engine to be able to handle it.

00:28:59 Pasi: And how was that received?

00:29:01 Rall: [Laughs] I don't think he turned completely red [laughs some more], the Colonel [laughs]. At the time I had no idea that a Second Lieutenant and a Colonel would not be able to communicate clearly on a technical matter. When I got back to the office I was called in by the head of the Aerodynamics Branch—and suggested—and told that he had been called up by the head of the Aircraft laboratory [laughs] because he had been called up by the head of the Propulsion Laboratory, [laughs] wanted to know who the hell this guy was that was standing up and contradicting him in front of the commander of the base of Wright Field. Well I, you know, it didn't bother me any. But my first OER, Officer Efficiency Rating, which comes around once a year—when I got that rating—how I did as a Lieutenant—it said this guy makes a great engineer, but he'll never make an officer. [Laughs] I agreed fully with that evaluation.

00:30:14 Pasi: And you were still an officer after that whole episode?

00:30:16 Rall: Oh I was still an officer yeah I was. It was clear I was never going to make a military career out of that.

- 00:30:22 Pasi: Well that maybe makes a nice segue into post-Korea and your leaving active duty from the Air Force, 1955, I think.
- 00:31:00 Rall: Right 1955. My two-year requirement—my duty was up. And I had all the plans to go back to California and continue living in Santa Monica, and working at Douglas. They had dropped by several times; my boss and his boss had dropped by at the base to talk to me, and said my job was waiting for me. And I was happy to go back. And two weeks before I was going to schedule to go back, my boss at Wright Field asked me if I wanted to stay on as a civilian. And I said “well,” I said “if you’ll make me a GS-13 I’ll stay on.” GS-13 was a pay grade. And my boss said “well they don’t make lieutenants GS-13s.” And I said “then I’m going to go back to the California.” Couple days later my boss came around and said—they’d—there’s a panel of people that wanted to meet with me up at the hill, which is where I think the Directorate of Laboratory was. And so I went up there and they explored with me what my background was, and what I had done and he said “well ok, thank you” and let me go back to work. And a couple of days later they said “we’ll make you a GS-13.” And so I stayed there [laughs] from 1955 to 1989.
- 00:32:11 Pasi: Became your home all of a sudden.
- 00:32:13 Rall: Yeah, that’s right; it really did. The reason—one of the big reasons—I wanted to stay here was that in that time two year time period that I been here, I got to do things and learn things, and meet people, and exchange ideas that I never would’ve been able to do as an individual working for any single company; doesn’t make any difference what the company was.
- 00:32:39 Pasi: Much more narrow focus say at Douglas?
- 00:32:41 Rall: Oh much more narrow than—so it was a much broadening experience and I was interested in learning and becoming a better engineer, and working my way up the chain. So this was a much better opportunity in my view. My father liked it because he said it had good retirement—
- 00:33:02 Pasi: Sure
- 00:33:03 Rall: —And benefits. And I said “yeah.” And he said it also had good security. So he gave me a vote of confidence after I made the decision. But my father was a great guy; he supported me in almost anything I wanted to do. And he was really a good man. He never got out of sixth grade by the way. And I couldn’t have asked for a better father.
- 00:33:30 Pasi: It’s amazing too that all these accomplishment, all this work your doing, but security and good benefits were still key. I think that’s fatherly advice.
- 00:33:41 Rall: I want to digress and jump ahead for just a second.

00:33:44 Pasi: Sure

00:33:45 Rall: Later on in the career, way back in the middle eighties sometime, I got an award in which the President Reagan was going to give it to me in the Rose Garden. And I got notified that I could take one guest with me. [Pauses--Sighs] Now—and of course—I was married at the time and so I couldn't invite [another] guest. But my father was living up here in a nursing home, Bethany Lutheran Village, and I was not going to take and leave him at home. So independent of the fact that they told me that I could take only one guest to the Rose Garden, I put my father and my bride in the car, and we drove off. And half way to Washington D.C., I called up the White House and told them I was bringing two people, and that they could choose which one [laughs] they didn't want me to bring in. [Laughs] Well they reluctantly agreed after that to let them both into the Rose Garden. My father was in a wheelchair and when they wheeled him through the magnetic detector to check for guns and stuff—of course it didn't make any difference cause you're in a wheelchair—so he had two secret service agents standing by him the whole time the ceremony was going on. And I really felt good that I could repay him a little bit [with] that kind of appearance.

00:35:19 Pasi: Sure, certainly, yeah.

00:35:21 Rall: Back to work.

00:35:23 Pasi: Well it certainly, for him then, it became more than just a job about benefits and security as he got to enjoy that award with you.

00:35:33 Rall: Oh yeah, it did. Yeah it did. Yeah he was great.

But when I became a civilian, I became head of—they created an internal aerodynamics unit in order to justify the GS-13 rating. And I—was my first time as a supervisor. I had two people reporting to me. And that was a new experience. I had a learning; went through the general government learning process, the short courses that they give you; how you fill out performance ratings and everything but—

00:36:07 Pasi: More managerial duties?

00:36:08 Rall: Yeah, all managerial kinds of things. But I was never really much good at it, nor really interested in it. I was more interested in getting them to work on the technical side.

But I—one of the things that happened early on in that, was that I got a call to go “down the hill” again to talk to a Colonel, who was in the management business but had an engineering background, who wanted to know why in supersonic tunnels the air temperature drops down to very low values. So I hopped down

there and sit down with the Colonel and I go through the derivations of the equations. And show him total temperature and static temperature and versus one plus gamma, over two minus one Mach number squared kind of thing and I said you see “it’s obvious that that’s the way it is.” [Laughs]

00:37:07 Pasi: It’s obvious.

00:37:08 Rall: He looked at me and he [laughs] said—he just shook his head and he said “I would like to know why the temperature goes down.” And I got to thinking; I said now I have to learn how to communicate these technical things to somebody who doesn’t have the same kind of experience and background that I do. And—I stumbled upon—ok now I said “temperature is a measure of the random motion of the molecules in the air. And I said now “so that the higher the random motion, the faster the motion is, the higher the temperature is.” I mean, and he understood that. And I could see the light in his eyes that he understood that. I said “now you take those molecules and you move them in a finite direction down the wind tunnel then you’re taking away some of that random energy and so the temperature’s going to drop.” And he said “my god;” he said he understood it. Now the important thing about that to me was that I began to appreciate that I had to find a way to communicate technical things in a manner that the—my audience would understand. So that was important to me and I never forgot that lesson.

00:38:30 Pasi: I would imagine that probably followed you throughout as you said because I mean as you—with each promotion at Wright-Patt I’m sure you were—had more and more people under you in which these communication skills you’re talking about probably played an major role.

00:38:45 Rall: And probably more important is talking to the people above you. I mean it’s the people above you who don’t have the experience, that need to understand in words that they can put together and make sense out of. And so I mean that I think I was pretty good at. But that was important.

While I was working in this internal aerodynamics unit we evaluated airplanes; we’d probably evaluate four airplanes a week on—sometimes; sometimes more, sometimes less. I would—my unit would—calculate what the installed thrust of the aircraft would be. And I’m talking about dealing with just paper. We didn’t have anything else but paper proposals from contractors. Cal Hargis, who would eventually become my roommate for reasons I’ll discuss later, would say what the drag of the airplane was and then we’d calculate what the performance of it was. And we got to be good friends we worked together and we did a lot of evaluations.

One aircraft that [laughs] stands out in my mind is the B-58. There was a great disagreement, before I got to Wright Field, between the aerodynamics branch that I worked in and the contractor, General Dynamics Fort Worth, on what the drag of the B-58 aircraft was. And it was never—never—never settled; never agreed

to. But the contractor came in with the proposal to do an aircraft called the B58-C. And it was the same B-58 except that the engines which were on the basic airplane, J-79 engines—were replaced—were to be replaced by the J-58 engine. The J-58 engine was being developed by Pratt & Whitney for what turned out to be the SR-71 program, “black” program. So it was a major step up in thrust and a major increase in performance. And because there was always this argument to begin with on what the drag of the basic B-58 was, it was also the same one we were asked to evaluate what the B58-C was. We took all the flight test data from the B-58 we could and we analyzed it, and we worked for three weeks. And I mean worked on it. I mean we worked twelve hour days and six days weeks sometimes. And we came up and we thought we really had a good job. And we put everything together and took it to our bosses you know, who nodded their heads and said “oh yes and oh.” The airplane didn’t go nearly as far as what the contractor said by our evaluation. But we—eventually we—ended up down in front of a commander of ASD on a Saturday afternoon with the management people who were running the B-58, which was back then was called the Weapons System Program Office, the Directorate of Laboratory, which was General Ascani, and our group from the Aerodynamics Branch. And we went through the whole thing—big presentation. [Laughs] And the General, the Commander, looked at it and he didn’t know what to do because he was having the contractor tell him one thing and here we are these Wright Field engineers telling him something else. General Ascani who was Directorate of Laboratories [laughs] solved that problem very easily. He said “I’ll tell you what we’ll do; since the disagreement boils down to what the B-58A will do, we’ll put the B-58A in San Francisco; pick one. And we’ll fly it due west as far as the contractor says it’ll go; turn it around at that point and bring it back to San Francisco. If it splashes, the Wright Field engineers are right. If it makes it back, the contractor’s right.” And that ended the whole discussion right there because they wouldn’t take that bet. I mean here’s an example of how hard we had worked to do a technical thing and the solution was really quite easy [laughs] and quite political, and made a lot of sense.

00:43:47 Pasi: And were contractors often reluctant to—well could you maybe describe that relationship a little bit between the contractors and Wright-Patterson? Because often you think, why didn’t—well why would they contract jobs out in the first place?

00:44:02: Rall: Well it begins; the relationship is really quite complicated. When I got to Wright Field the Wright Field engineers and the contractors were adversaries. What they did was—the contractors tended to exaggerate in order to get a winning proposal. And there were competitions and competitions led to claims that they thought they might be able to do. And when the engineers at Wright Field evaluated they’d tend not to be as optimistic as the contractor was, so you ended up with the conflict. There was never an attempt to really resolve the issue. It was always “that contractor doesn’t know what he’s doing” kind of attitude, and the contractor would say “Wright Field engineers are no ‘cotton-pickin’ good;

they've never worked in the industry; they don't know how to do it and they just continually are pessimistic."

00:45:14 Pasi: So there was that kind of—

00:45:14 Rall: Absolutely. Pessimistic.

00:45:13 Pasi: —Those thoughts about one another.

00:45:17 Rall: Right. I mean it was just conflict after conflict, which was very destructive in the long run. Early on I learned that you didn't have to operate that way.

I was—as an example—I evaluated a proposal for the F-104 aircraft to use the J-79 engine. And there was a—I won't go into great detail of the engine design, but it had an ejector nozzle that was supposed to act like a convergent-divergent nozzle at high speed where you attained more thrust. It's like if you look at a current day rocket engine you'll see the flare of the nozzle coming out of the—like it was supposed to act like. And they claimed that there was a twenty percent thrust increase due to this particular nozzle design at Mach number two. My experience suggested that that wasn't true. So I went through and I spent a week going through detailed calculations as to what it would be, and I came out that the contractor was right. It was twenty percent increase in thrust. And I had used data from an NACA report. NACA was the National Advisory Committee for Aeronautics which was the forerunner of what turned into NASA. And that was what everybody—I was—they were using the same fundamental database that I was. But I still didn't believe the answer that I came up with, so I went back and looked at how NASA—N-A-C-A—had actually prepared the data to see if they had changed their presentation method and they had. And when you took that into account, the twenty percent turned out to zero percent. And so I told my boss who told the program office down the hill that was what happened and next day I got a call from Kelly Johnson, and Kelly Johnson—and here I am talking to this guy—wants to know what do I mean that there's twenty percent loss in thrust at mach number two.

00:47:46 Pasi: And Johnson was at Douglas?

00:47:47 Rall: No, Lockheed—Lockheed—[Johnson] was the head of—eventually the head of—skunk works which did the U2 aircraft and the SR-71 aircraft. And my first experience with Kelly. So I said ok, yeah I really believe this and I'd be happy to come out there and show it to you.

So my bosses arranged first for me to go down to General Electric in Evendale here and talk to them and I went over their great work, and they didn't say "yea" or "nay," they just took it and said "thank you for your interest in the public defense."

Then I went down to Convair, Fort Worth, because they were using the same engine design in the original B58-A. And then I went out to Lockheed to talk to Kelly and his people. In fact the first time I met Ben Rich, who was eventually Chief Engineer out there, and told him what had happened. And they—nobody patted me on the back and said “that’s a good thing” because here they are hanging out and they got a proposal and [laughs] an airplane with insufficient thrust.

I just went back home and waited, and two weeks after I got back home, I [laughs] received a letter from General Electric saying that there was a problem at Mach 2 and they were down twenty percent in thrust, that their compressor design was inadequate and they were going to have to change the compressor; so the first series of engines they produced wouldn’t be satisfactory. They didn’t say what the real problem was; they said “it was a problem that they could fix.” And I said to myself “it doesn’t make any difference to me that they are going to blame it on a compressor rather than on the real problem” because as long as the airplane performs I don’t really care.

00:49:43 Pasi: Right.

00:49:44 Rall: And so it became important not to save face and not [sic]—to let the contractors save face, and [laughs] after that General Electric really treated me well whenever I came there. [Laughs] They invited me to their preliminary designs and design review on their engines and we got along famously. It was a good experience. But I said to myself it doesn’t make any sense to have an argument back and forth when you can sit down and agree with rational people.

00:50:28 Pasi: And to have an aircraft that works in the end run.

00:50:30 Rall: Yeah that’s what the objective was.

00:50:34 Pasi: Well this relationship between the contractor and the laboratories and engineering departments at Wright-Patterson—one of your old friends, General Stewart, who I think was instrumental in your promotion to eventually Deputy for Engineering, he said that the person in that position had to be an engineer first and a manager second. And would you say that that was something that held true, or would you have a different opinion about that.

00:51:11 Rall: Oh yeah, absolutely, absolutely. There’s no question about it. If you’re not an engineer first—that doesn’t mean you don’t have to have managerial skills, you certainly did, but if you’re not an engineer first—you’re not going to get the respect of either the contractors or the people you got working for you.

00:51:30 Pasi: True

00:51:30 Rall: —Or your higher-up bosses. [Laughs] And as life went on and I attended

higher level meetings—and Secretaries of the Air Force and that kind of level—they'd ask questions which a manager could never answer; an engineer could answer. And you stood up and you answered them. And it was the only way to function. That was one of the problems with Wright Field is that they tended to promote—and I'm talking civilians now not military—they tended to promote on the basis of age. "You know you've been here this long; you ought to be good and so you're going to get promoted from this grade to that grade." And that's not—really not—ought not to be the way it worked. And later on I was able to modify that slightly; reward the engineering capability and not the number of years of the individual.

There was a major sea change at Wright Field in 1959. Prior to 1959 the management of the programs were "down the hill", in what were called Weapons System Program Offices. There was no technical support supplied to them other than by the laboratories. In order to receive technical support they had to write a sub-order up to the laboratory who would then farm it out to the appropriate division, branch, individual, and that thing. And whether or not the sub-order got treated promptly or not was completely up to the individual. There was no consideration of what the answer would be to that sub-order from a total system perspective. It was always from a component. If this is what you wanted to do for this component this is the way, the best component you should be and of course the airplanes are not best components; they're best systems and so you have to make them balanced.

00:53:52: Pasi: So it wasn't real holistic approach to systems?

00:53:55 Rall: Right. And so the program managers didn't like that kind of response from the laboratory. And you can't blame them; I mean the laboratory guys never knew what the time constraints were that they were dealing with, or what the cost implications were going to be. And so there was no communication back and forth that was really effective.

In 1959 they created an Engineering Group which was dedicated to only supporting weapons system programs. So part of the laboratories went into the System Engineering Group and part of them stayed as laboratories. I always liked the actual aircraft development part of it and so I opted to stay in the system engineering group, or move to system engineering group rather than stay with the laboratories.

They also at that time created Super SPOs: B-70, Dyna-Soar, a few others. And I opted to go for the B-70 because it was the fastest, most sophisticated technical aircraft that we were working on at the time. And I became head of the Aerodynamics Branch during that time period.

The B-70 was a great overall design. It suffered from structural problems. It was made out of stainless-steel; honeycomb structure was. It had all sorts of problems

associated with it. Airplane never made it into production. Probably because one, it cost too much. Two—it was being considered—SR-71 was considered to be a relatively cheaper option to the B-70. And so we sort of—in fact we also crashed one airplane when an F-404 during a photo opportunity crashed into the wingtip and the B-70 was lost.

00:56:28 Pasi: Regarding cancellations of systems. That's something I'd like to talk about, but this may be a good time to take a break. And we'll continue with part II of the interview in just a minute.

00:56:39 Rall: Great.

End of Video Tape 1.